## BIOGRAPHICAL SKETCH

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NAME: von Morze, Cornelius

eRA COMMONS USER NAME (credential, e.g., agency login): morze1

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

| INSTITUTION AND LOCATION | DEGREE *(if applicable)* | Completion Date MM/YYYY | FIELD OF STUDY |
|---|---|---|---|
| University of California, Berkeley | B.S. | 05/2001 | Bioengineering |
| University of California, San Francisco / Berkeley | Ph.D. | 03/2008 | Bioengineering |
| University of California, San Francisco | Postdoctoral | 02/2014 | Radiology |

### A. Personal Statement

I am a new Assistant Professor in the Department of Radiology at Washington University (start date Feb. 1 2019), who was recruited from my prior role as a Sr. Development Engineer at UCSF, to lead a new program in hyperpolarized (HP) $^{13}$C MRI research. My training in bioengineering brings me the extensive skills in physics, mathematics, and computer programming needed to solve complex technical problems in medical imaging research. I have a great deal of experience in multiple areas of MRI research including acquisition pulse sequence development, reconstruction, post-processing, and imaging data analysis. I have a broad background in imaging research from both academic and industrial perspectives, including both preclinical and clinical imaging studies. My publication record demonstrates an ability to develop and translate useful new imaging research methods.

- von Morze C, Ohliger MA, Marco-Rius I, Wilson DM, Flavell RR, Pearce D, Vigneron DB, Kurhanewicz J, Wang ZJ. “Direct assessment of renal mitochondrial redox state using hyperpolarized $^{13}$C-acetoacetate”. Magnetic Resonance in Medicine. 2018. Pubmed PMID: 29314217.
- von Morze C, Tropp J, Chen AP, Marco-Rius I, Van Criekinge M, Skloss TW, Mammoli D, Kurhanewicz J, Vigneron DB, Ohliger MA, Merritt ME. Sensitivity enhancement for detection of hyperpolarized 13C MRI probes with 1H spin coupling introduced by enzymatic transformation in vivo. Magnetic Resonance in Medicine. 2018. Pubmed PMID: 29193287.
- von Morze C, Allu PK, Chang GY, Marco-Rius I, Milshteyn E, Wang ZJ, Ohliger MA, Gleason CE, Kurhanewicz J, Vigneron DB, Pearce D. Non-invasive detection of divergent metabolic signals in insulin deficiency vs. insulin resistance in vivo. Scientific Reports. 2018. Pubmed PMID: 29391429.
- von Morze C, Reed GD, Larson PE, Mammoli D, Chen AP, Tropp J, Van Criekinge M, Ohliger MA, Kurhanewicz J, Vigneron DB, Merritt ME. In vivo hyperpolarization transfer in a clinical MRI scanner. Magnetic Resonance in Medicine. 2018. Pubmed PMID: 29488244.

### B. Positions and Honors

**Positions**

| | |
|---|---|
| 05/2001 – 02/2003 | Biomedical engineer (full-time), Magnetic Resonance Imaging Research Lab, General Electric Global Research Center (GRC), Niskayuna, New York |
| 12/2003 – 03/2008 | Graduate student researcher, University of California, San Francisco |
| 04/2008 – 02/2014 | Postdoctoral scholar, University of California, San Francisco |

| | |
|---|---|
| 03/2014 – 01/2019 | Sr. Development Engineer, University of California, San Francisco |
| 02/2019 – | Assistant Professor, Washington University School of Medicine |

**Honors**

| | |
|---|---|
| 1997-2001 | Regents' Scholarship, University of California, Berkeley |
| 2008 | Nominee, Krevans Distinguished Dissertation Award |
| 2010 | Margaret Hart Surbeck Young Investigator Award |
| 2010 | Best speaker award, Radiology and Biomedical Imaging Research Symposium, University of California, San Francisco |
| 2012 | Seed Grant, UCSF Department of Radiology and Biomedical Imaging, "Development of Tri-Polarized Perfusion MRI Methods" |
| 2013 | Award for Scientific Excellence, Young Investigators Forum of the American Society of Nephrology (ASN), sponsored by the Kidney Council on Vascular Disease (KCVD) |
| 2013 | Renal Grand Rounds, Emory University, Atlanta. "Hyperpolarized $^{13}$C Urea MRI" |
| 2014 | Certification of Course Completion (93%), "Machine Learning", Coursera/Stanford |

**Professional Memberships**

| | |
|---|---|
| 2002 | Six Sigma "Greenbelt" certification in statistical methods for business |
| 2002- | Member, International Society for Magnetic Resonance in Medicine (ISMRM) |
| 2008- | Reviewer for *Magnetic Resonance in Medicine, Journal of Magnetic Resonance Imaging, PLOS One,* and *Neurosurgery* |
| 2013- | Member, American Society of Nephrology |

**C. Contributions to Science**

1. My initial graduate research focused on **accelerating MRI**, which is traditionally slow and thus expensive and uncomfortable, **using customized hardware**. At GE, I contributed to the design of a novel modular gradient coil for highly accelerated MRI. As a graduate student, I designed and built an advanced eight-channel phased array RF detector with novel nonoverlapping geometry specifically designed for fast imaging.

a. von Morze, C., Tropp, J., Banerjee, S., Xu, D., Karpodinis, K., Carvajal, L., Hess, C.P., Mukherjee, P., Majumdar, S., Vigneron, D.B. (2007). An eight-channel, nonoverlapping phased array coil with capacitive decoupling for parallel MRI at 3T. Concepts in Magnetic Resonance Part B- Magnetic Resonance Engineering, 31B(1), 37-43.

b. Aksel, B., Marinelli, L., Collick, B.D., von Morze, C., Bottomley, P.A., Hardy, C.J. (2007). Local planar gradients with order-of-magnitude strength and speed advantage. Magnetic Resonance in Medicine, 58(1), 134-43. PMID: 17659620.

2. Further graduate work applied my detailed knowledge of MRI to **high field MR angiography (MRA)**. We recognized early on that increased sensitivity and longer $T_1$ nuclear magnetic relaxation times at 7 Tesla would lead to unprecedented vessel contrast with clinical value. In collaboration with neuroradiology, I conducted MRA in volunteers & clinical patients applying custom multi-channel reconstruction algorithms that I developed for rapid parallel imaging. We published the first 7T MRA studies, followed by several other groups.

a. von Morze, C., Xu, D., Purcell, D.D., Hess, C.P., Mukherjee, P., Saloner, D., Kelley, D.A., Vigneron, D.B. (2007). Intracranial time-of-flight MR angiography at 7T with comparison to 3T. Journal of Magnetic Resonance Imaging, 26(4), 900-4. PMID: 17659620.

b. von Morze, C., Purcell, D.D., Banerjee, S., Xu, D., Mukherjee, P., Kelley, D.A., Majumdar, S., Vigneron, D.B. (2008). High-resolution intracranial MRA at 7T using autocalibrating parallel imaging: initial experience in vascular disease patients. Magnetic Resonance Imaging, 26(10), 1329-33. PMID: 18508216.

3. My postdoctoral work transitioned to the exciting new area of hyperpolarized (HP) $^{13}$C MRI. I developed a new highly efficient type of **HP $^{13}$C pulse sequence ("SSFP")** with much higher image quality than standard methods for HP [$^{13}$C]urea MRI (now attaining unprecedented 1mm resolution). I applied the sequence initially in cancer models, also using new data analysis methods for computing tumor perfusion and permeability parameters simultaneously for the first time by co-hyperpolarizing multiple tracers with different lipophilicities.

a. von Morze, C., Larson, P.E., Hu, S., Keshari, K., Wilson, D.M., Ardenkjaer-Larsen, J.H., Goga, A., Bok, R., Kurhanewicz, J. (2011). Imaging of blood flow using hyperpolarized [$^{13}$C]urea in preclinical cancer models. Journal of Magnetic Resonance Imaging, 33(3), 692-7. PMID: 21563254.

b. von Morze, C., Reed, G.D., Shin, P.J., Larson, P.E.Z., Hu, S., Bok, R., Vigneron, D.B. (2011). Multi-band frequency encoding method for metabolic imaging with hyperpolarized [1-$^{13}$C]pyruvate. Journal of Magnetic Resonance, 211(2), 109-113. PMID: 21596601.

c. von Morze, C., Sukumar, S., Reed, G.D., Larson, P.E., Bok, R.A., Kurhanewicz, J., Vigneron, D.B. (2013). Frequency-specific SSFP for hyperpolarized $^{13}$C metabolic imaging at 14.1T. Magnetic Resonance Imaging, 31(2):163-70. PMID: 3651030.

d. von Morze, C., Bok, R.A., Reed, G.D., Ardenkjaer-Larsen, J.H., Kurhanewicz, J., Vigneron, D.B. (2013). Simultaneous multiagent hyperpolarized $^{13}$C perfusion imaging. Magnetic Resonance in Medicine. PMID: 24382698.

4. My involvement as a postdoc in the new area HP $^{13}$C MRI led to the opportunity to establish a highly novel line of research in developing the **application of HP $^{13}$C MRI to kidney disease**, a relatively unexplored area, motivated by the superb depiction of renal anatomy noted on HP images that I had been acquiring. I have established projects on high resolution [$^{13}$C]urea renography as well as imaging renal/hepatic gluconeogenesis in diabetes by spectroscopic imaging of HP glucose precursors, in collaboration with UCSF nephrology.

a. von Morze, C., Chang, G.Y., Larson, P.E., Shang, H., Allu, P.K., Bok, R.A., Crane, J.C., Olson, M.P., Tan, C.T., Marco-Rius, I., Nelson, S.J., Kurhanewicz, J., Pearce, D., Vigneron, D.B. (2016). Detection of localized changes in the metabolism of hyperpolarized 13C gluconeogenic precursors $^{13}$C-lactate and $^{13}$C-pyruvate in kidney and liver. Magnetic Resonance in Medicine. DOI: 10.1002/mrm.26245. PMID: 27098724.

b. von Morze, C., Bok, R.A., Ohliger, M.A., Zhu, Z., Vigneron, D.B., Kurhanewicz, J. (2015). Hyperpolarized [$^{13}$C]ketobutyrate, a molecular analog of pyruvate with modified specificity for LDH isoforms. Magnetic Resonance in Medicine. DOI: 10.1002/mrm.25716. PMID: 26059096.

c. von Morze, C., Bok, R.A., Sands, J.M., Kurhanewicz, J., Vigneron, D.B. (2012). Monitoring urea transport in rat kidney in vivo using hyperpolarized $^{13}$C magnetic resonance imaging. American Journal of Physiology- Renal Physiology, 302(12):F1658-62. PMID: 22492940.

d. von Morze, C., Bok, R.A., Ohliger, M.A., Zhu, Z., Vigneron, D.B., Kurhanewicz, J. (2015). Hyperpolarized [$^{13}$C]ketobutyrate, a molecular analog of pyruvate with modified specificity for LDH isoforms. Magnetic Resonance in Medicine. DOI: 10.1002/mrm.25716. PMID: 26059096.

**Complete List of Published Work:**
https://www.ncbi.nlm.nih.gov/myncbi/browse/collection/47522925/?sort=date&direction=descending

**D. Research Support**

**Ongoing Research Support**

1) NIH K01 DK099451 (von Morze) 4/1/2014 - 3/31/2019
Molecular Imaging of Renal Transport and Metabolism using Hyperpolarized $^{13}$C MRI

The goal of this project is to develop the application of new hyperpolarized $^{13}$C MRI technology for monitoring kidney disease. An important aspect of this research is determining the relative role of metabolic changes in the kidneys and liver in diabetes. This project also includes a mentored career development component for Dr. von Morze to achieve his ultimate career goals as an independent investigator.

Role: PI

2) UCSF Liver Center Pilot/Feasibility Grant (von Morze) 6/1/2017 - 11/31/2018
NIH P30 DK026743
Effect of therapeutic ACC inhibition on hyperpolarized $^{13}$C MRI in intact rat liver

The goal of this project is to investigate potential non-invasive imaging markers of therapeutic response in non-alcoholic steatohepatitis (NASH) in rats, in response to a novel therapeutic approach, inhibition of acetyl-CoA carboxylase.

3) NIH R01 DK115987 (von Morze) 9/1/2018 - 8/31/2023
Novel hyperpolarized 13C molecular imaging techniques for differentiating NAFLD and NASH

Hyperpolarized $^{13}$C magnetic resonance imaging (MRI) is an emerging molecular imaging modality with a unique capability to access intermediary energy metabolism in a non-invasive manner, which is currently

undergoing translation into human studies at several sites internationally in studies of cancer and cardiovascular disease. The goal of this new R01 project is to investigate a new application of hyperpolarized 13C MRI to the assessment of NAFLD.

4) NIH P41 EB013598 (Vigneron) 8/1/2011 - 5/31/2021
Hyperpolarized MRI Technology Resource Center

This new NIH NIBIB Biomedical Technology Research Technology center focuses on the technological development of new preclinical hyperpolarized carbon-13 MRI. It will fund three Technology Research and Development projects for: 1) the development of new dynamic nuclear polarization (DNP) and HP-MRI techniques; 2) New HP probes and cell/tissue HP-techniques; 3) Specialized HP MRI reconstruction and analysis techniques. These technical resource developments are driven through seven intramural Collaborative Projects and four Extramural Service Projects.

Role: Sr. Development Engineer